Omaha Public Power District

444 South 16th Street Mall
Omaha NE 68102-2247

August 31, 2005
LIC-05-0101

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Reference:
1. Docket No. 50-285
2. Letter from Bruce A. Boger (NRC) to Ross Ridenoure (OPPD) dated September 13, 2004, NRC Generic Letter 2004-02: Potential Impact Of Debris Blockage On Emergency Recirculation During Design Basis Accidents At Pressurized-Water Reactors (NRC-04-0115) (ML042360586)
3. Letter from Ralph L. Phelps (OPPD) to Document Control Desk (NRC) dated March 4, 2005, 90 Day Response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors" (LIC-05-0017) (ML050630538)
4. Letter from Alan B. Wang (NRC) to Ross Ridenoure (OPPD) dated June 3, 2005, Request for Additional Information (RAI) Related to Generic Letter 2004-02, Potential Impact Of Debris Blockage On Emergency Recirculation During Design Basis Accidents At Pressurized-Water Reactors (TAC No. MC4686) (NRC-05-0077) (ML051520156)
5. Letter from D. J. Bannister (OPPD) to Document Control Desk (NRC) dated August 1, 2005, Fort Calhoun Station Unit No. 1, Response to Request for Additional Information Related to Generic Letter 2004-02, Potential Impact Of Debris Blockage On Emergency Recirculation During Design Basis Accidents At Pressurized-Water Reactors (LIC-05-0090) (ML052130305)

SUBJECT: Follow-up Response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors"

In Attachment 1 of this letter, the Omaha Public Power District (OPPD) provides the required follow-up response information requested in Reference 2. The 90-day response to Reference 2 was provided in Reference 3. Attachment 2 lists the commitments made in the response.

In addition, OPPD is working with the NRC as a pilot plant for resolution of Generic Safety Issue (GSI) 191, "Assessment of Debris Accumulation on PWR Sump Performance".

I declare under penalty of perjury that the foregoing is true and correct. (Executed on August 31, 2005.)

If you have additional questions, or require further information, please contact Thomas R. Byrne at (402) 533-7368.

Sincerely,

Harry J. Faulhaber
Division Manager
Nuclear Engineering

HJF/TRB/trb

Attachment 1 - Response to NRC Generic Letter 2004-02, "Follow-Up Response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors"

Attachment 2 – List of Commitments

ATTACHMENT 1

Follow-Up Response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors"

Follow-Up Response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors"

The Omaha Public Power District (OPPD) is participating in the GSI-191 Pilot Plant Program. The pilot plant kickoff meeting was held on July 14, 2005 in Washington, DC. As part of this pilot OPPD has submitted the Debris Generation, Debris Transport, the computational fluid dynamics (CFD) analysis, head loss related materials, and Downstream Effects Analysis to the NRC. In addition, the NRC has observed plant specific head loss testing facilitated by GE and performed a general containment walk down during the 2005 Refueling Outage (RFO).

NRC Request 2a:

[Provide] Confirmation that the [emergency core cooling system] ECCS and [containment spray system] CSS recirculation functions under debris loading conditions are or will be in compliance with the regulatory requirements listed in the Applicable Regulatory Requirements section of this generic letter. This submittal should address the configuration of the plant that will exist once all modifications required for regulatory compliance have been made and this licensing basis has been updated to reflect the results of the analysis described above.

OPPD Answer:

The FCS ECCS and CSS recirculation functions will be in compliance with the regulatory requirements listed in the Applicable Regulatory Requirements section of the subject generic letter under debris loading conditions by December 31, 2007. Compliance will be achieved through a series of analyses and testing based on the guidance provided in NEI 04-07, and the associated NRC safety evaluation report (SER), in addition to other industry guidance as applicable. OPPD will demonstrate full compliance through analysis, mechanistic evaluations, modifications to increase the available sump screen area and other changes to the plant to reduce the potential debris loading on the recirculation sump strainers. OPPD plans to implement programmatic and process changes to ensure continued compliance.

By December 31, 2007, OPPD will have installed new sump strainers to increase the available screen area from the current approximately 56 square feet to an expected area of approximately 2800 square feet or greater. The exact strainer size that will be installed has not been finalized as of this date. The proposed replacement strainer size is based on the best available knowledge at this time for the proposed installation areas, potential debris generation and transport, and potential head loss across the screen. The proposed new strainers are to be installed in or near the current strainer locations within containment.

The final designs of the screens, including final resolution of all open issues such as downstream effects and chemical effects will be addressed in the final Design Change Package. Testing of the proposed new strainer design using plant specific debris loading will be performed to determine the strainer debris loaded head loss. The final design analysis will be based on the post 2006 RFO as-built plant configuration.

To meet the requirements of this Generic Letter, several activities have been or will be completed in accordance with the guidance provided in the GR (Guidance Report) and SER (Safety Evaluation Report), except as noted in this attachment. These activities are summarized below. Additional details are provided in the OPPD Answers to NRC Requests 2c, 2d and 2f. Exceptions to the Applicable Regulatory Requirements and guidance documents that have currently been identified are included in this response. If additional exceptions are utilized, OPPD plans to identify those compliance exceptions.

- Containment Walkdowns – OPPD has performed containment walkdowns to assess potential debris sources. The walkdowns include sampling of latent debris, verification of insulation types and locations, and evaluation of potential sump strainer locations. The walkdowns are consistent with the guidelines provided in NEI 02-01, (Reference 4). The majority of this work was completed during the 2003 RFO with follow up and confirmatory walkdowns performed during the 2005 RFO.

- Debris Generation and Transport Analyses – Bounding debris generation (Reference 5) and debris transport analyses (Reference 6 and 7) were performed in support of a Baseline analysis. The Baseline evaluation was performed in accordance with the GR and SER except as described in the OPPD Answer to NRC Request 2c. These analyses are planned be updated to reflect the as-built plant configuration and resolve any open items that required validation. OPPD is considering using the Alternate Evaluation methodology as describe in Chapter 6 of the GR if the strainer size required to meet the baseline case is considerably larger than anticipated.

- Calculation of Required and Available Net Positive Suction Head (NPSH) – OPPD is currently assessing the required and available NPSH for the new strainers. The current FCS design basis takes credit for a minimal amount of Containment Overpressure. OPPD is taking several actions to improve NPSH margins. Based on the results of these analyses, it may be necessary for OPPD to request an increase in the currently approved amount of overpressure or a change to the methodology used to calculate overpressure/subcooling.

- Determination of Strainer and Screen Requirements (and/or modifications planned) - OPPD plans to replace existing sump strainers and install new strainers to assure compliance with applicable regulatory requirements. The existing screen area is approximately 28 square feet per train or 56 square feet total. The total screen area of the replacement and new strainers has not yet been finalized but is expected to be 2800 square feet, or greater. The screens for the strainers are planned to have round openings with a proposed maximum diameter of 3/32 inch. The design of these strainers will minimize head loss and bypass due to the small hole size.

- Evaluation of Other Potential Modifications – OPPD plans to replace the Steam Generators and Pressurizer at FCS during the 2006 RFO. At that time, the Calcium Silicate (with and without asbestos) and Tempmat (high density fiberglass) insulation on these vessels are planned to be replaced with Reflective Metal Insulation (RMI). The portions of the interconnecting piping insulation are also planned to be replaced with low density fiberglass. Other modifications currently planned or under consideration include installation of new drain caps for the Reactor

Pressure Vessel (RPV) cavity drain and refueling cavity drain, RPV flange seal ring spacers and removing the autostart feature from one of the three containment spray pumps.

- Strainer Structural Analysis – The new replacement strainers will meet the design basis requirement for structural analysis in accordance with the FCS design and licensing basis.

- Implementation of Measures to Assure Continued Compliance – To assure attributes needed for continued compliance are maintained, OPPD plans to review existing engineering design specifications, engineering design standards, engineering programs, modification and maintenance processes and procedures, and station operation processes and procedures to ensure the inputs and assumptions that support the analyses identified in this attachment are incorporated into the applicable documents. OPPD is also considering establishing and maintaining beyond design basis procedures for dealing with a potential fully or partially blocked sump strainer as implemented in our response to NRC Bulletin 2003-01 (Reference 8).

- Downstream Effects Evaluation – A downstream effects evaluation has been performed consistent with WCAP-16406-P, (Reference 9). This evaluation is a two phase process. These evaluations assessed the susceptibility for blockage of required flow areas and the potential for abrasive wear to detrimentally impact the required ECCS and CS functions. Review and acceptance of these analyses is in progress.

- Upstream Effects Evaluation – OPPD has completed the upstream effects evaluation and developed a new water level calculation to ensure adequate sump pool depth. This evaluation focuses on flow paths to the recirculation sump and if there are potential upstream blockage points. The need for some minor modifications was identified as a result of this evaluation.

As part of the modification and analysis process, OPPD intends to update the design and licensing basis to reflect the results of the modifications and analyses.

The OPPD Answer to NRC Request 2b, below, describes the corrective actions required to ensure this compliance. All additional information provided relates to the plant configurations following completion of the described corrective actions.

NRC Request 2b:

[Provide] A general description of and implementation schedule for all corrective actions, including any plant modifications that you identified while responding to this generic letter. Efforts to implement the identified actions should be initiated no later than the first refueling outage starting after April 1, 2006. All actions should be completed by December 31, 2007. Provide justification for not implementing the identified actions during the first refueling outage starting after April 1, 2006. If all corrective actions will not be completed by December 31, 2007, describe how the regulatory requirements discussed in the Applicable Regulatory Requirements section will be met until the corrective actions are completed.

OPPD Answer:

OPPD plans to implement all required plant modifications the first refueling outage after April 1, 2006. The first refueling outage after April 1, 2006 is scheduled for Fall 2006. Planned actions to be implemented during this refueling outage to support this Generic Letter include replacement of the existing strainer(s) with new large passive strainer(s) and replacement of some insulation and coatings. In addition, other design, licensing, and operational changes are being evaluated.

Containment Walkdowns

Containment walk downs for determination and/or validation of debris sources including insulation and latent debris have been completed during the 2003 and 2005 refueling outages (Reference 10). In addition, strainer hardware installation walkdowns and laser scanning were performed during the 2005 RFO.

Strainer Hardware Modification

Based on the results from debris generation and transport analyses identified and described below, modifications to the existing debris screens will be implemented to meet the applicable Regulatory Requirements discussed in the Generic Letter. The current design consists of two simple screen strainers with a surface area of 28 square feet or a total of 56 square feet. The proposed strainer design utilizes a passive stacked disk design fabricated from perforated plate, with several individual strainer modules interconnected. The proposed total strainer size is estimated to be approximately 2800 square feet. Final strainer size and the associated head loss will be based on plant specific testing of the proposed strainer design. The new strainer design includes 71 square feet of sacrificial surface area for tapes, labels, etc. The proposed screen opening sizes is 3/32 inches (0.09375 inches). The new screens will occupy a significantly larger space than the currently installed strainers requiring relocation of existing interferences. The new strainers are planned to be installed during the 2006 RFO. Strainer head loss testing is planned to be completed by September 2005.

Insulation and Coatings Changes

A significant amount of Calcium Silicate (with and without asbestos) and TempMat (high density fiberglass) insulation in Containment is planned to be removed during the 2006 RFO. During the 2006 RFO, the existing steam generators (SGs) and the pressurizer are planned to be replaced. The replacement SGs and pressurizer will be insulated with Reflective Metal Insulation (RMI). In addition, high heat aluminum coatings that are currently used on the SGs and pressurizer will not be installed on the new components.

RPV Flange Seal Ring Spacers Modification

During refueling operation, the RPV flange seal ring is installed between the vessel and the refueling cavity with gaskets to support flood up of the cavity area. During normal operation the gaskets are removed and the seal ring is only bolted in place on the inner radius (RPV side). During the 2006 RFO, spacers are planned to be installed on the inner radius of the seal ring to increase the size of the gap between the seal ring and the refueling cavity. This increased gap provided by the seal ring spacer will minimize water retention in the refueling cavity and provide increased water level in the containment sump pool thereby increasing available NPSH. This modification credits a flow path from the reactor cavity to the containment sump pool.

Reactor Cavity and Refueling Cavity Drain Cap

Modification of the reactor cavity and refueling cavity drain caps is being evaluated for installation during the 2006 RFO to minimize potential debris blockage.

Potential Modifications and License Amendments

OPPD is currently assessing the required and available NPSH for the new strainers. The current FCS design basis takes credit for a minimal amount of containment overpressure. OPPD is taking several actions to improve NPSH available margins. Evaluation work is in progress to consider the effects of changing pump operation after the Recirculation Activation Signal (RAS) to improve NPSH margin. Other evaluations include reducing NPSH requirements to minimize dependence on subcooling and overpressure. Crediting additional containment overpressure or changing the methodology to calculate subcooling is being considered. Either of these changes could require a license amendment.

OPPD is considering using the Alternate Evaluation methods identified in the GR and SER. This option may be implemented to provide additional design margin beyond the baseline case to compensate for unknowns such as chemical effects or coating assumptions. If debris loads and strainer head loss are worse than expected, OPPD may choose this methodology to meet applicable requirements. The use of Alternate Evaluation methods may require a license amendment.

The downstream effects and chemical effects evaluation is presently ongoing. Based on current analysis, no modifications have been identified at the present time. However, if any modifications related to downstream effects or chemical effects are identified, implementation will take place during the Fall 2006 RFO, if practicable. An update to this response will be provided if additional modifications are identified and will include a description of the modification and implementation schedule.

Implementation Date

The strainer hardware modification, insulation removal from SGs and Pressurizer, RPV Flange Seal ring spacer, changes to pump operation, and replacement of drain caps are planned for implementation during the 2006 RFO, which is prior to the December 31, 2007 requirement of the Generic Letter.

If additional plant modifications are identified from technical evaluation of downstream effects, chemical effects or other technical reviews, a supplement to this GL response will be provided to describe the modification and associated schedule.

Currently, OPPD has not identified the need for any additional operational changes that will be made as a result of this ongoing effort. Operational changes will be implemented as necessary to improve plant performance or design margins.

NRC Request 2c:

[Provide] A description of the methodology that was used to perform the analysis of the susceptibility of the ECCS and CSS recirculation functions to the adverse effects of post-accident debris blockage and operation with debris-laden fluids. The submittal may reference a guidance document (e.g., Regulatory Guide 1.82, Rev. 3, industry guidance) or other methodology previously submitted to the NRC. (The submittal may also reference the response to Item 1 of the Requested Information described above. The documents to be submitted or referenced should include the results of any supporting containment walkdown surveillance performed to identify potential debris sources and other pertinent containment characteristics.)

OPPD Answer:

OPPD has performed analyses to determine the susceptibility of the ECCS and CSS recirculation functions at FCS to the adverse effects of post-accident debris blockage and operation with debris-laden fluids. These analyses conform to the NEI 04-07 (Reference 1) methodology (GR) as approved in the NRC Safety Evaluation Report (Reference 2) to the greatest extent practicable, except for the refinements and exceptions noted in the paragraphs below. In some cases, these analyses are on-going utilizing additional refinements. Specifically, analyses supporting debris transport utilizing the planned strainer and other hardware modifications (described in the OPPD Answer to NRC Request 2b above) have not yet been completed. Specific sensitivity runs have yet to be completed for various debris and transport scenarios. Vendor specific testing of the sump strainer utilizing FCS specific debris mix is currently in progress. Chemical effects testing for head loss, to validate assumed margins, does not have a firm start date at this time. If additional plant modifications are identified from technical evaluation of downstream effects, chemical effects or other technical reviews, a supplement to this GL response will be provided to describe the modification and associated schedule.

Many of the analyses and evaluations identified in the OPPD Answer to NRC Request 2b were performed by organizations under contract to OPPD. The Debris Generation and Transport analysis was performed by Alion Science and Technology (Alion), and walkdowns for NEI 02-01 were performed by Enercon and Alion. Strainer hardware will be supplied by General Electric Company with Sergeant and Lundy (S&L) providing support for all design change activities. In addition, S&L is providing support for the chemical effects evaluation and downstream effects wear and blockage evaluation. Framatome ANP is supporting S&L with downstream effects for the RPV internals and fuel blockage evaluation. OPPD is a member of the Utilities Service Alliance (USA) and is participating in the coating Zone of Influence (ZOI) testing.

The following activities were included in the analyses to determine the susceptibility of the ECCS and CSS recirculation functions to the adverse effects of debris generation:

1. Break Selection
2. Debris Generation/Zone of Influence (Excluding Coatings)
3. Debris Characteristics (Excluding Coatings)
4. Latent Debris
5. Debris Transport
6. Coatings Evaluation
7. Head Loss

8. Chemical Effects
9. Upstream Effects
10. Downstream Effects

The specific approach used for each of these activities is described below.

1. Break Selection and Debris Generation Calculation (Reference 5)

FCS is a two loop (designated as loops A & B) Pressurized Water Reactor. Each loop consists of one steam generator (SG), two reactor coolant pumps (RCPs) and the associated reactor coolant system (RCS) piping. The containment is considered highly compartmentalized. The two loops are nearly identical with the exception that loop A includes the pressurizer (PZR) and its associated piping.

Several break locations are selected for evaluation. Breaks in feedwater and/or main steam system piping are not considered as they will not require the ECCS and/or containment spray systems to operate in the recirculation mode to perform a design basis function. In accordance with NEI 04-07, small-bore piping (2 inch nominal diameter and less) is not considered, as the impact will be bounded by the larger breaks.

The FCS Updated Safety Analysis Report (USAR) classifies LOCAs as an instantaneous rupture of a RCS pipe ranging in cross-sectional area up to, and including, that of the largest pipe in the RCS. The full spectrum of LBLOCAs requires ECCS sump operation. A 14 inch diameter medium break LOCA (MBLOCA) in the RCS was analyzed to evaluate debris that could be generated from a break other than a full double-ended guillotine break (DEGB) on the hot leg. A review of the Piping and Instrumentation Diagrams (P&IDs) associated with the RCS was performed to identify those lines directly attached to the RCS (up to the first isolation valve). The LBLOCA lines are:

- 32 inch RCS (hot leg)
- 24 inch RCS (cold leg, including RCP suction and discharge piping)
- 12 inch Safety Injection (SI) up to the first check valve
- 12 inch Shutdown Cooling (SDC) up to the first isolation valve
- 10 inch RCS Surge Line to Pressurizer

The FCS USAR provides an analysis of a spectrum of cold leg break sizes to determine the most limiting SBLOCA for debris generation. Only break sizes greater than 0.49 square feet (3 inch ID pipe) were considered because smaller breaks result in the plant being cooled down, depressurized, and placed on SDC prior to reaching RAS. Therefore, only SBLOCA lines 3 inch and larger require recirculation and are included in this evaluation. The SBLOCA lines included are:

- 3 inch RCS to Spray Control Valves
- 4 inch Pressurizer Code Safety and PORV lines

Debris generation involves the selection of postulated break locations and determining an associated volume of debris generated. Debris generation involves a mechanistic exercise of identifying a HELB, establishing the corresponding ZOI, mapping the ZOI volume over the spatial layout of insulated piping and components, and calculating the volume of insulation within that ZOI. A number of breaks in each high-pressure system that rely on recirculation was considered and reasonably bounds variations in debris generation by the size, quantity and type of debris. As a minimum, the following break locations have been considered:

Break No. 1: Breaks in the RCS with the largest potential for debris.
Break No. 2: Large breaks with two or more types of debris.
Break No. 3: Breaks in the most direct path to the sump.
Break No. 4: Large breaks with the largest potential particulate debris to insulation ratio by weight.
Break No. 5: Breaks that generate a "thin bed" – high particulate with 1/8 inch fiber bed.

The walkdown identified several types of insulation within the containment. The majority of the insulation in containment is in the two steam generator bays includes Calcium Silicate (Calsil) with and without asbestos, NUKON® and Thermal Wrap (low density fiberglass), Temp-Mat®, and RMI insulation. Since the largest amount of insulation is in the same zone that has several different types of debris, Break No. 1 will envelope Break No. 2. In addition, Break No. 4 is designed to primarily capture particulate type insulation and is screened out by Break No. 5. Therefore, only Breaks No. 1, 3, 5 and the MBLOCA are evaluated in this calculation.

OPPD is planning to install new insulation on the replacement steam generators and pressurizer during the 2006 RFO. To determine what type of insulation to procure, two (2) debris load cases have been developed and analyzed for these breaks:

Case 1: Steam Generators/Pressurizer with Reflective Metallic Insulation (RMI) and the remaining material per walkdown report.

Case 2: All Calsil inside the bioshield replaced with low-density fiberglass insulation, such as ThermalWrap or NUKON®, and the remaining material the same as Case 1.

OPPD is planning to install RMI on the Steam Generators and Pressurizer as described in Case 1. Case 2 was considered less desirable due to the extensive asbestos abatement. The Case 2 evaluation data will be deleted from the affected analysis when the as-built final design is issued. The data presented in this GL response will be focused on Case 1 only. Table 1 below identifies the total insulation inventory inside containment.

Table 1 Insulation Quantity by Location Case 1

Insulation Type	Total	Inside Bio-Shield	Outside Bio-Shield
Calcium Silicate	140.16 ft^3	82.49 ft^3	57.67 ft^3
Calcium Silicate/Asbestos	837.61 ft^3	480.67 ft^3	356.94 ft^3
Cerafiber	4.53 ft^3	2.60 ft^3	1.93 ft^3
Charcoal	1,248.00 ft^3	0.00 ft^3	1,248.00 ft^3
Fiberglass	909.33 ft^3	0.00 ft^3	909.33 ft^3
Foam Rubber	12.05 ft^3	0.97 ft^3	11.08 ft^3
NUKON®	28.23 ft^3	13.01 ft^3	15.22 ft^3
Pabco HD Supertemp	12.69 ft^3	0.00 ft^3	12.69 ft^3
Temp-Mat®	398.23 ft^3	343.61 ft^3	54.62 ft^3
RMI	100,873.34 ft^2	100,873.34 ft^2	0.00 ft^2

The FCS GSI-191 Debris Generation Calculation identified three limiting breaks for the sump screen debris source term. The Large Break Loss of Coolant Accident (LBLOCA) was the break that produced the largest and most varied quantity of debris. Two of the three limiting breaks evaluated consist of different debris mixes for the LBLOCA. The third limiting break is the Small Break Loss of Coolant Accident (SBLOCA), the break with the most direct path to the sump. The SBLOCA case is not specifically analyzed in this debris transport calculation as it is assumed that 100% of the debris generated is transferred to the sump. The LBLOCA is discussed below.

The break with the largest potential for debris generation is the largest break (LBLOCA) in an area with the largest concentration of debris source material. The largest breaks, and the breaks with the largest zone of influence, are the RCS hot-leg breaks inside the steam generator bay walls. The RCS hot-leg break that generated the largest amount of fibrous and Calsil debris was chosen for the limiting breaks. For analysis purposes, a High Particulate Scenario (highest Calsil to fiber ratio) is anticipated to be the worst case (Table 2). A second LBLOCA high fiber scenario (highest fiber to Calsil ratio) was also selected (Table 3). The worst case LBLOCA debris loads were selected from the Steam Generator B Bay, which also has the shortest transit path to the sump strainer. In addition, one of four reactor coolant pumps (RCP D) still has Calsil insulation. RCP D is located in Bay B and is the source for the worst case Calsil debris load.

Table 2 Break No. 1 LBLOCA
RCS Break B Bay - Break at discharge RC-3D Generation Case 1
HIGH PARTICULATE SCENARIO

Insulation Type	Quantity Destroyed
Calcium Silicate	0.15 ft^3
Calcium Silicate/Asbestos	93.3 ft^3
Cerafiber	1.72 ft^3
NUKON®	1.33 ft^3
Temp-Mat®	23.30 ft^3
RMI	33,645.68 ft^2

Table 3 Break No. 1 LBLOCA
RCS Hot-Leg SG Bay A DEGB Debris Generation Case 1
HIGH FIBER SCENARIO

Insulation Type	Quantity Destroyed
Calcium Silicate	4.81 ft^3
Calcium Silicate/Asbestos	49.41 ft^3
Cerafiber	0.88 ft^3
Foam Rubber	0.54 ft^3
NUKON®	2.30 ft^3
Temp-Mat®	162.47 ft^3
RMI	33,645.68 ft^2

Break No. 3 (Table 4) is the break with the most direct path to the sump. Of the two worst case breaks evaluated, a break in the 3 inch Spray Control Valve piping from the RCS to the spray control valves was selected due to the close proximity to the sump resulting in assuming 100% transport. The debris loads for this case are as follows:

Table 4 Break No. 3
Breaks in the most direct path to the sump
Case 1 - Control Valve Line Scenario

Insulation Type	Quantity Destroyed
Calcium Silicate	5.39 ft^3
Calcium Silicate/Asbestos	38.97 ft^3
Fiberglass	61.33 ft^3
Temp-Mat®	2.36 ft^3

In addition to the above, OPPD has also analyzed the worst case Medium Break LOCA using a 14 inch line break and the location that will generate the highest particulate load (Table 5). This case was selected in anticipation of using Alternate Evaluation Methodology as described in Section 6 of the GR and SER. OPPD anticipates using this methodology if additional margin is required to be demonstrated due to calculation uncertainties such as chemical effects.

Table 5 Break No. 1 MBLOCA
RCS 14 Inch Breach Debris Generation Case 1

Insulation Type	Quantity Destroyed
Calcium Silicate	0.00 ft^3
Calcium Silicate/Asbestos	36.3 ft^3
Cerafiber	0.88 ft^3
Foam Rubber	0.54 ft^3
NUKON®	2.30 ft^3
Temp-Mat®	87.92 ft^3
RMI	33,645.68 ft^2

<u>Exception(s) Taken to GR and SER for Break Selection</u>

The only criterion in the GR and SER for which an exception was taken was the requirement in Section 3.3.5.2 of the SER that breaks be assumed to occur every five feet as described. Due to the small volume and highly compartmentalized configuration of the FCS containment, the overlapping ZOIs that would result from this requirement essentially covered the same locations. The approach used for FCS was to determine the limiting debris generation locations (based on the ZOI) and then determine the break location that would provide this debris. Due to the varied debris mix, OPPD has focused this review on providing the worst case particulate (Calsil) and worst case fiber ratios. This simplification of the process did not reduce the debris generation potential for the worst case conditions as described in Section 3.3 of the GR and the SER.

In addition, OPPD has evaluated the equivalent of a 14 inch line break. Since FCS is a small PWR, the largest pipe connection to the RCS is the 10 inch pressurizer surge line. The pressurizer is planned to be insulated with RMI and is not a worst case break. OPPD has conservatively evaluated the effect of a 14 inch break in the RCS piping at the worst location for particulate. This break is bounded by the full pipe break at this location and bounds the smaller pipe breaks. The debris generation data from the 14 inch break will only be used if OPPD decides to utilize alternate evaluation methods to increase design margin.

2. Debris Generation and ZOI (Excluding Coatings) (Reference 5)

The debris generation evaluation consisted of two primary steps:

- Determine the ZOI in which debris is generated.
- Identify the characteristics (i.e., size distribution) of the destroyed debris.

The ZOI is the volume around the break in which the jet pressure is greater than or equal to the destruction damage pressure of the insulation, coatings, and other materials impacted by the break jet. Both the GR and the SER characterize the ZOI as spherical and centered at the break site or location. The radius of the sphere is determined by the pipe diameter and the destruction pressures of the potential target insulation or debris material. All potentially important debris sources (insulation, coatings, etc.) within the ZOI were evaluated in the FCS analysis.

Section 4 of the GR allowed for the development of target-based ZOIs, taking advantage of materials with greater destruction pressures. The FCS evaluation used multiple ZOIs at the specific break locations dependent upon the target debris. The destruction pressures and associated ZOI radii for common PWR materials were taken from Table 3-2 of the SER.

Robust barriers consisting of structures and equipment that are impervious to jet impingement were credited in the evaluation. These barriers included the bioshield and associated compartment walls. The guidance in the GR and SER was used as applicable.

Based on the evaluation, the total debris generated is summarized in Table 6 below:

Table 6 Total Debris Summary Table

INSULATION DEBRIS	CASE 1 LARGE PIECES	CASE 1 FINES
BREAK NO. 1 – LARGEST POTENTIAL FOR DEBRIS		
HIGH FIBER SCENARIO		
Calcium Silicate	0.00 ft^3	4.81 ft^3
Calcium	0.00 ft^3	49.41 ft^3
Cerafiber	0.00 ft^3	0.88 ft^3
*Foam Rubber	0.54 ft^3	0.00 ft^3
NUKON®	0.92 ft^3	1.38 ft^3
Temp-Mat®	64.99 ft^3	97.48 ft^3
RMI	33,645.68 ft^2	0.0 ft^3
HIGH PARTICULATE SCENARIO		
Calcium Silicate	0.00 ft^3	0.15 ft^3
Calcium	0.00 ft^3	93.3 ft^3
Cerafiber	0.00 ft^3	1.72 ft^3
*Foam Rubber	0.54 ft^3	0.00 ft^3
NUKON®	0.53 ft^3	0.80 ft^3
Temp-Mat®	9.32 ft^3	13.98 ft^3
RMI	33,645.68 ft^2	0.0 ft^3
BREAK NO. 3 – MOST DIRECT PATH TO THE SUMP		
Calcium Silicate	0.00 ft^3	5.39 ft^3
Calcium Silicate/Asbestos	0.00 ft^3	38.97 ft^3
Fiberglass	0.00 ft^3	61.33 ft^3
Temp-Mat®	0.94 ft^3	1.42 ft^3
COATINGS DEBRIS		
Qualified Coatings 4 L/D ZOI	0	150 lbm
Qualified Coatings 10 L/D ZOI	0	941 lbm
Unqualified Coatings	0	1125 lbm
LATENT DEBRIS		
Particles	0	80.3 lbm
Fibers	0	4.4 lbm
Others	0	74.3 lbm
Stickers/Tape Reduce Strainer Screen Area	71.0 ft^2	0

3. Debris Characteristics (Excluding Coatings)

The following are the debris characteristics associated with insulation types found inside the FCS containment and generated as a result of a LOCA. The two parameters of interest regarding the generation of debris are destruction pressure and debris size distribution. As stated, the destruction pressure relates to the ZOI (higher material destruction pressure results in a smaller ZOI), and the debris size distribution provides the physical sizes and associated quantities expected.

The actions taken to document and quantify the location and types of debris present in the FCS containments included:

- Review of existing insulation isometric drawings.
- Review of past maintenance job orders for activities performed that modified or replaced insulation.
- Confirmatory walkdowns in accordance with Reference 4 during the 2003 RFO and additional walkdowns during the 2005 RFO to identify any changes.

The results of these activities were compiled into a report used in performing the applicable analyses and evaluations. Programmatic controls ware planned to be put in place to maintain this configuration control.

The insulation types, general locations, and potential debris quantities that were used in the evaluations are summarized above in Table 1.

Insulation

With the exception of Low Density Fiberglass (LDFG) all insulation debris types are quantified using the Zone of Influence (ZOI) radius specified by the SER in Table 7:

Table 7

Type	ZOI (Note 2)	Debris Size Distribution	Comment
RMI	17.1D (See Note 1)		It has been shown that RMI does not contribute significantly to head loss.
Jacketed NUKON®	17.1D	40% small fine 60% large pieces	
Temp-Mat®	11.7D	40% small fine 60% large pieces	
Cerafiber	All Cerafiber within the bioshield is assumed to be destroyed.	100% small fines	
Calsil & Calsil with Asbestos	5.5D	100% small fines	
Foam Rubber			When destroyed this insulation floats and is not considered in the head loss analysis as the sump is completely submerged.
Filter Media – Charcoal & Fiberglass		Low Density Fiberglass – 100% small fines Filter media – large pieces.	Per the walkdown no filter media is located within the bioshield and therefore not subject to debris generation as a result of a LOCA.
Pabco HD Supertemp (Calcium Silicate) fire barrier Board Panel			Per the walkdown no HD Supertemp is located within the bioshield and therefore not subject to debris generation as a result of a LOCA.

Note 1 - The ZOI for NUKON® is applied to RMI. RMI has a higher destruction pressure therefore, this is conservative.

Note 2 - For all piping insulation debris except Cerafiber and LDFG, a 3D model is used to identify piping within the ZOI and calculate the impacted insulation volume. For all equipment insulation except LDFG, the sections of insulation within the ZOI are determined based on dimensioned insulation and plant layout drawings.

Exception(s) Taken to the GR and SER for Debris Characteristics

For the Baseline evaluation, no exceptions were taken to the GR or the SER. For refined analysis, OPPD is performing testing using the SER size distribution for Calsil assuming 100% particulate. OPPD anticipates that exceptions may be taken with regard to the size distribution of calcium silicate insulation within the ZOI. OPPD plans to consider this option after plant specific strainer testing is performed with baseline methodology. OPPD believes 100% particulate is overly conservative.

4. Latent Debris

A latent debris walkdown was performed during the 2003 RFO. Approximately 8 latent debris samples were collected and sent to Los Alamos National Labs (LANL) for evaluation (Reference 5). This data was used to develop the debris generation calculation and resulted in an estimation of 159 lbm. The method used during the 2003 RFO deviates slightly from NEI 04-07 methodology which was issued after the debris was collected. This method uses a metal scraper and brush resulting in aggressive mechanical agitation of the surface. This method would result in removal of any loosely adhered coating or latent debris. The LANL report indicated that some of the smaller particles were not collected using this method. During the 2005 RFO, and new draft procedure was developed and used to collect 24 samples using the GR and SER methodology. This evaluation resulted in approximately 85 lbm of latent debris. This method uses a maslin wipe to collect debris, which is less aggressive. The 2005 RFO method collected samples from the same basic areas as the 2003 data collection with many more locations. For both data collections, samples from each of the following surfaces were taken:

- Floor areas
- Walls
- Cable Trays
- Equipment (such as air handlers, ventilation, ducts, etc.)
- Other surfaces as appropriate (junction boxes, etc.)

The 2005 RFO debris load collected was considerable less that the 2003 RFO debris load and the values used in the debris generation calculation. This data collection provides validation of the latent debris load value used in the Debris Generation Calculation. The reduced debris load collected during the 2005 RFO is credited to improvements in housekeeping and a change in debris collection methods. It was noted that the 2003 debris sample had fewer small particles as compared to other collection methods evaluated by LANL. Latent debris is not considered a major contributor to the overall debris load at FCS since FCS has a high particulate load due to the use of Calsil insulation.

Exception(s) Taken to the GR and SER for Latent Debris

The GR provides a recommended latent debris load of 200 lbm. OPPD has used data from plant specific testing to determine the correct debris load. The use of plant specific data is not considered an exception to the methodology.

5. Debris Transport Calculation (Reference 6 and 7)

The analysis of debris transport utilized the containment layout information so that debris transport pathways were assessed. Flooding information identified physical volumes within containment that can retain debris and prevent its transport to the sump. The recirculation transport analysis was performed by ALION using CFD models developed using the computer program FLUENT. The CFD models were created by RWDI, Inc. Outputs of the CFD analysis include global (entire containment) and local (near sump pit) velocity contours, turbulent kinetic energy (TKE) contours, path lines and flow distributions for various scenarios. Miscellaneous debris (tape, labels, etc.) is not included in the debris load, but is considered in the screen design as a sacrificial area.

This CFD analysis determines the amount of debris that transports and the amount of debris that settles during recirculation.

The overall transport methodology used to determine the amount of debris transported is based on the methodology reported in NUREG/CR-6762 Vol. 4 and that presented in Section 3.6.3 of the NEI Sump Evaluation Methodology and same section in the SER. The standard logic tree approach is utilized.

The debris transport analysis considered each type of insulation and debris size. The analysis also considered the potential for further decomposition (erosion) of the debris as it is transported to the sump screen. Instantaneous transport of debris is assumed, as this is the most conservative approach.

The transport fractions are dependent on the path the debris is expected to travel from the ZOI to the sump screen. Therefore, not only the transport fraction, but the type and size of the insulation, and break locations are considered as well.

Based on a review of plant configuration, FCS is considered to be a highly compartmentalized containment. A CAD model was developed as part of the CFD assessment and provides an illustration of the compartmentalization of the FCS containment at several levels. Each SG is separated by block walls in addition to the RCPs. Each SG is fully separated and located

180 degrees apart. A break in one SG Bay area cannot communicate with the other bay area. The blowdown forces can only translate upwards or through doors. There are no openings through the bioshield wall except for pipe and instrument penetrations. As such, use of the "Base" logic trees for a highly compartmentalized containment is appropriate. The transport model considered small fines and large pieces. The following transport mechanisms were considered: blowdown transport, washdown transport, pool fill transport, and recirculation transport.

A "Baseline" logic tree was used for debris transport analysis in the NEI Sump Evaluation Methodology. This calculation began with this "Baseline" logic tree and refined it to consider plant specific attributes. This calculation includes erosion of large pieces which is consistent with the SER, but was not included in the NEI "Baseline" logic tree.

Fibrous debris was characterized into four debris size categories based on the interpretation of the AJIT test data. The NEI small fines category was subdivided into fines (8%) and small pieces (25%) and the NEI large category was subdivided into large pieces (32%) and intact debris (35%). All fines were considered to transport to the screen. Based on the comparison of recirculation pool velocities determined using CFD analysis with incipient debris tumbling velocities provided in NUREG/CR-6762, the small pieces and large pieces do not transport to the screen in bulk, but are subject to erosion and subsequent transport as fines. For the purpose of screen sizing, 60% of the small and large piece fiber was determined to erode prior to shutoff of containment spray (at which point the total recirculation flow is significantly reduced, thereby significantly reducing the head loss across the screen). For long-term evaluations, 90% of the small and large piece fiber is considered to erode. Intact debris does not erode or transport to the screen.

All containment spray and submergence generated fibrous debris is modeled as fines and 100% transports to the screen. All particulate and coating debris was modeled as fines and 100% transports to the screen.

The RMI size distribution is based on the categorization provided in the SER (Appendix II). For Mirror the values used are 1.6% fines and 98.4% large debris. For Transco the values used are 75% fines and 25% large debris. Based on the comparison of recirculation pool velocities determined using CFD analysis with incipient debris tumbling velocities provided in NUREG/CR-6772, the large RMI pieces do not transport to the screen. Erosion of RMI debris is not modeled.

The debris transport phenomena due to the blowdown, washdown, pool fill-up, and recirculation transport modes are summarized using debris transport logic trees consistent with the Drywell Debris Transport Study (DDTS) documented in NUREG/CR-6369. The debris transport logic trees consider the effect of dislocation, hold up on the floor or other structures, deposition in active or inactive pools, lift over curbs, and erosion of debris.

The following is a summary of the overall transport fractions for all debris types:

Table 8: Debris Transport Fractions

Load Case	Debris Transport Fraction (DTF)
LBLOCA Fibrous Debris	57%
LBLOCA Calcium Silicate	90%
LBLOCA Reflective Metallic Debris	26%
SBLOCA Fibrous Debris	100%
SBLOCA Calcium Silicate	100%
SBLOCA Reflective Metallic Debris	100%
Large Particulate Debris (without debris interceptors, unqualified coatings)	50%
Large Particulate Debris (with debris interceptors, unqualified coatings)*	5%
Small Particulate Debris	90%
Latent Debris	100%

Table 9 provides the final debris loads to reach the sump strainer. Table 9 summarizes the three design basis load cases.

Table 9: Case 1 Total Debris Load at Strainer

INSULATION DEBRIS	CASE 1 TOTAL VOLUME GENERATED (LARGE PIECES AND FINES)	DTF	VOLUME/ MASS OR AREA AT STRAINER
BREAK NO. 1 – LARGEST POTENTIAL FOR DEBRIS			
HIGH FIBER SCENARIO			
Calcium Silicate	4.81 ft^3	0.9	4.33 ft^3
Calcium	49.41 ft^3	0.9	44.47 ft^3
Cerafiber	0.88 ft^3	0.57	0.50 ft^3
Foam Rubber	0.54 ft^3	0.00	0.00 ft^3
NUKON®	2.30 ft^3	0.57	1.31 ft^3
Temp-Mat®	162.47 ft^3	0.57	92.61 ft^3
RMI	33,645.68 ft^2	0.26	8,747.88 ft^2
HIGH			
Calcium Silicate	0.15 ft^3	0.90	0.14 ft^3
Calcium	93.3 ft^3	0.90	83.97 ft^3
Cerafiber	1.72 ft^3	0.57	0.98 ft^3
Foam Rubber	0.54 ft^3	0.00	0.00 ft^3
NUKON®	1.33 ft^3	0.57	0.76 ft^3
Temp-Mat®	23.30 ft^3	0.57	13.28 ft^3
RMI	33,645.68 ft^2	0.26	8,747.88 ft^2
BREAK NO. 3- MOST DIRECT PATH TO THE SUMP			
Calcium Silicate	5.39 ft^3	1.00	5.39 ft^3
Calcium Silicate/Asbestos	38.97 ft^3	1.00	38.97 ft^3
Fiberglass	61.33 ft^3	1.00	61.33 ft^3
Temp-Mat®	2.36 ft^3	1.00	2.36 ft^3
COATINGS DEBRIS LBLOCA			
Qualified Coatings 4 L/D ZOI	150 lbm	0.90	135 lbm

INSULATION DEBRIS	CASE 1 TOTAL VOLUME GENERATED (LARGE PIECES AND FINES)	DTF	VOLUME/ MASS OR AREA AT STRAINER
Qualified Coatings 10 L/D ZOI	941 lbm	0.90	847 lbm
Unqualified Coatings (with debris interceptors/without debris interceptors)	1125 lbm	0.05/0.50	56.3/563 lbm
LATENT DEBRIS			
Particles	80.3 lbm	1.00	80.3 lbm
Fibers	4.4 lbm	1.00	4.4 lbm
Others	74.3 lbm	1.00	74.3 lbm
Stickers/Tape Reduce Strainer Screen Area	71.0 ft^2	1.00	71.0 ft^2

Exception(s) Taken to the GR and SER for Debris Transport

As previously discussed in the debris generation section, OPPD is considering the use of testing to determine the transport capability of Calsil. These phenomena may reduce the transport predicted by the analysis.

An additional item that is being considered for use is the results, when issued, of the Electric Power Research Institute (EPRI) testing performed for unqualified materials in accordance with Reference 11. OPPD provided sample material from a crane to EPRI for evaluation. The results identified no failure of the unqualified OEM coating. These options will be evaluated after strainer hardware testing is completed with the baseline case. OPPD plans to identify this exception in a separate submittal after the EPRI test data is evaluated.

6. Coating Evaluation

Consistent with Sections 3.4.3.3.3 and 3.4.3.3.4 of the GR, qualified and unqualified coatings within the coating ZOI were assumed to fail and all unqualified coatings outside the coating ZOI were assumed to fail. Based on recommendations in the associated SER, all coatings inside and outside the ZOI were assumed fail as 10 micron spherical particles. EPRI is currently testing unqualified coating systems to determine debris characteristics. This EPRI data may be used when the information becomes available. If OPPD elects to use this data the manner in which it is used will be described in a separate submittal after the EPRI test data is evaluated. In accordance with the GR, unqualified coatings that are under intact insulation were not considered to fail.

All qualified coating debris is quantified using the ZOI radius of 10.0D, as specified by the SER in Section 3.4.2.1. The Utilities Service Alliance has contracted with Westinghouse to have qualified coatings tested under two phase flow conditions to determine appropriate ZOI for assuming that 100% of the coatings will fail. OPPD is one of the utilities participating in this effort. It is expected that the results of this testing will support the 4D ZOI assumed for the generation of qualified coatings debris. A base case for head loss determination has also been made with the 10D ZOI to identify and quantify the differences between the two head loss effects.

The final calculations will be updated to reflect a ZOI based on actual test data. All concrete and structural steel coatings within the ZOI are determined based on dimensioned plant drawings. For the purpose of determining impacted coating volumes, all coated surfaces within the ZOI are assumed to have the maximum of the possible thickness values specified by both current and historical specifications.

The results of this evaluation for the worst case LBLOCA are as follows:

- Total mass qualified coatings 4 L/D ZOI 150 lbm
- Total mass qualified coatings 10 L/D ZOI 941 lbm
- Unqualified coatings 1,125 lbm

<u>Exception(s) Taken to the GR and SER for Coatings Evaluation</u>

As previously described in the section discussing debris transport, an exception to the GR and SER may be taken with regard to size of the debris caused by failure of unqualified coatings, based data from planned EPRI testing. Additionally, an exception to the GR and SER Section 3.4.2.1, regarding the qualified coatings ZOI, is being taken based on the results of planned confirmatory testing. OPPD will identify this exception in a separate submittal after the test results have been evaluated.

7. <u>Head Loss (Reference 12)</u>

A preliminary head loss evaluation at debris laden condition has been developed based on vendor testing performed during the strainer hardware procurement process (Reference 12). See the OPPD Answer to NRC Request 2d(i). The debris head loss analysis is predicted based on head loss testing, the proposed strainer configuration at applicable flow rates, and representative debris loading. Plant specific detailed strainer hardware testing is scheduled to be completed by September 2005 and is planned to be used for final strainer sizing based on a conservative debris load. OPPD has chosen to use testing due to limitations identified in the methodology for applying the NUREG – 6224 correlation to a debris bed with a Calsil to fiber ratio greater than 20%. The proposed 2800 square feet strainer is expected to have very low approach velocities which will promote settling in the area around the strainer. In addition, the final debris load is expected to be reduced to take advantage of reduced coating loads based on industry test data. Upon completion of the strainer design, OPPD will update the strainer head loss and overall NPSH calculations to reflect the as-built plant configuration.

Exception(s) Taken to the GR and SER for Head Loss

There were no specific exceptions taken to the completion of the head loss analysis as described in the GR and SER. OPPD considers the use of plant specific testing to be bounded by the guidance provided in the GR and SER.

8. Chemical Effects Evaluations (Reference 13)

Chemical Effects Evaluations are based on draft reports and industry presentation data. FCS uses Trisodium Phosphate (TSP) as the buffer. A comparison of the ERPI/NRC Integrated Chemical Effects Test (ICET) and the FCS plant specific parameters is being performed and indicates Test 3 is most applicable to FCS. Sump strainer suppliers are currently developing plans and schedule to quantify the additional head loss associated with chemical debris. OPPD plans to incorporate chemical effects in the strainer final design once the tests to quantify chemical debris effect on head loss have been quantified. Some NPSH margins in the current design have been reserved to account for chemical effects. At the same time, an additional evaluation will be performed to determine the impact of the sump pH, containment spray flow to area ratio and duration, and the increased temperature profile on the head loss due to chemical effects. See the OPPD Answer to NRC Request 2d(i).

A comparison of the ICET chemical test summary for Test #3 and the Fort Calhoun plant specific parameters has been performed. The comparison shows that with the exception of aluminum, carbon steel, concrete surface area, sump pH, sump water temperature profile, and spray flow to area ratio and duration, the ICET chemical test parameter values bound the FCS values. Although not bounded, the values are close and it is judged that the impact on the test results would not be significant. The plant aluminum ratio is only approximately 5% greater than the test ratio. The plant carbon steel area ratio is approximately three times the test ratio. The concrete surface area ratio is approximately 12 times the test ratio. From the ICET test results, concrete and carbon steel do not appear to contribute to the precipitate. Therefore, the excess amounts of concrete surface area and carbon steel are not significant. The summary of the comparison is as follows:

Material	ICET Test Ratio	ICET Percentage of Material Submerged (%)	FCS Plant Ratio	Percentage of Material Submerged (%)
Zinc in Galvanized Steel (ft^2/ft^3)	8.0	5	4.0	5
Inorganic Zinc Primer Coating (Non-Top Coated) (ft^2/ft^3)	4.6	4	--	4
Aluminum (ft^2/ft^3)	3.5	5	3.68	5
Copper (Including Cu-Ni alloys) (ft^2/ft^3)	6.0	25	0.299	25
Carbon Steel (ft^2/ft^3)	0.15	34	0.456	34
Concrete (surface) (ft^2/ft^3)	0.045	34	0.54	34
Concrete (particulate) (lbm/ft^3)	0.0014	100	0.001	100
Insulation Material (ft^3/ft^3)	0.137	75	0.0031	100
Sump pH Min-Max	7.2-7.3	----	7.0 - 8.0	---
Sump Temperature (deg. F)	140	----	120-245°F	---
Spray Duration	4 hours	----	5 hours	----
Spray Flow to Area Ratio (ft/hr)	1.75	----	5.65	----

Margin from Flow Rates and Sump Pool Temperature

Chemical effects are considered to be a time dependant debris source. Following a Recirculation Actuation Signal (RAS), the flow required to maintain the necessary core cooling decreases significantly. OPPD normally will secure the containment spray pumps (the largest flow source) after approximately five hours of operation. This will result in a significant flow reduction and ensuing reduction in head loss across the debris bed. As the flow decreases, the head loss also decreases, thus minimizing the impact of debris laden strainer.

In addition, the sump pool temperature will continue to decrease after RAS. The reduced sump pool temperature will provide additional sub cooling and result in an increase in NPSH available. At the present time, OPPD credits overpressure using a formula that restricts credit for sub cooling even with the containment at atmospheric pressure. OPPD is considering a license amendment to increase credit for containment overpressure or the methodology for calculating sub cooling. The margin for chemical effects will be validated using testing and included in the final head loss calculations.

Exception(s) Taken to the GR and SER for Chemical Effects

At this time, OPPD does not expect to take any exceptions to the GR and SER recommendations regarding chemical effects. OPPD will provide the updated estimated margin allocated to account for chemical effects upon completion of the final head loss calculation.

9. Upstream Effects Evaluation (Reference 14)

OPPD has completed upstream effects evaluation to determine flow paths, hold up volumes, and restricted flow areas. This evaluation was performed during the NEI 02-01 walkdowns during the 2003 RFO with additional details collected during the 2005 RFO. The scope of work included development of a new containment sump pool minimum water level calculation (Reference 15)

In accordance with the guidance in the GR and the SER, OPPD reviewed the current plant design. The upstream analysis concludes that to minimize the potential for water retention, spacers should be installed in the reactor cavity seal ring. In addition, to minimize drain blockage, a new drain cap with a trash rack function should be installed for the reactor cavity and refueling cavity drains. These potential upstream effects conditions will be resolved by the modifications described in the OPPD Answer to NRC Request 2b.

The upstream evaluation considered all flow paths in containment. The FCS containment is a dry ambient pressure containment housing a Combustion Engineering pressurized water reactor. The FCS containment can be divided into five general compartments separated by grated floors (elevations in feet).

- Elevation 976 to 994 –reactor vessel cavity
- Elevation 994 to 1013 – the bottom of the containment with the floor at the 994 elevation referred to as the basement floor.
- Elevation 1013 to 1045 – the middle section with access to the steam generator bays at 1013, referred to as the intermediate floor.
- Elevation 1045 and above – the upper part of containment with access to the top of the refueling cavity at the 1045 elevation, referred to as the operating floor.
- The refueling cavity- This cavity extends from elevation 1038 downward to the bottom of the cavity at elevation 995.5.

The following are the pertinent characteristics of FCS associated with potential debris transport paths following a postulated high energy line break:

- The containment sprays are of a multiple concentric ring design and are location the inside of the dome with a direct line of sight to the grated floor at elevation 1045.
- The containment air coolers are located at 90 degrees quadrant from plant north mounted on a pedestal at elevation 1060 (referred to as the operating platform)

- The flooring at elevation 1045 and 1013 is predominately grating. The grating is supported at the top of the steam generator bays at elevation 1045. The grating at elevation 1013 is supported by the sides of the containment walls and the steam generator bioshield. The portion of these floors that are concrete drain with no obstruction to the grated portion of the floor.
- The two steam generators are housed in enclosures (called the bioshield) that span vertically between elevations 994 and 1056. Each of these enclosures also contains two reactor coolant pumps. These bays have openings at elevation 994 and 1013 and are covered by grating at 1045. There are no solid floors associated with the steam generator bays except at the bottom at elevation 994.
- The pressurizer has its own well with access at elevation 1013.
- The two ECCS sumps are located at approximately 315 degrees at elevation 994.

ELEVATION 1045

The flooring at this elevation is mostly grating. There is a clear and direct line of sight to the containment spray header rings from this elevation. Regarding possible pool formation, the small areas of concrete floor have good drainage and have very few impediments such as toe-rails or curbing. The curbing at the edge of some grating has gaps of over ½ inch and does not present a hold up of water. There is a line of sight looking down through the grating to the 994 elevation at most locations. The grating at 1013 is also clearly visible for this elevation. The horizontal surfaces of the Containment Air Coolers will drain containment spray water to the edges of the horizontal surfaces of the coolers with minimum water retention. The area under the air handler pedestals has 2 inch drains. In the event that these drains were to become clogged, there is a clear unobstructed path to either the refueling cavity or the grated floors. It is not credible to have a pool of any significance at elevation 1045 or higher.

ELEVATION 1013

Elevation 1013 is the next major floor down from elevation 1045. The flooring at 1013 is predominately grating. At this elevation there is access to the steam generators, reactor coolant pumps and pressurizer. The small areas of concrete floor have good drainage and have very few impediments such as toe-rails or curbing. The curbing at the edge of some grating has gaps of over ½ inch and does not present a hold up of water. It is concluded that it is not credible to have a pool of any significance at elevation 1013. All water that reaches elevation 1013 would readily continue unimpeded to elevation 994.

ELEVATION 994

Elevation 994 is the basement floor of containment and represents the lowest accessible surface in containment. There are numerous footings for equipment such as the pressurizer quench tank throughout the floor. There is however significant spacing between the obstructions that would not adversely impact the movement of water and debris.

The access openings to the steam generator bays have doors meant for radiological control that are locked closed during power operations. Water spilled from the RCS during a LOCA that subsequently falls into the SG bay from Containment Spray would need to pass through this opening to flow to the ECCS sump. These doors are lightly constructed and most of the surface area is expanded sheet metal mesh in a diamond pattern. The door design will allow free passage of water through the door. The diamond pattern will pass objects less than ¾ inch diameter. There is also a 5 inch or more gap below each door and a 14 inch or more gap above each door. It is unlikely that fibrous debris could build up on the expanded metal to significantly clog the flow through the door. Even if this door were to become clogged by fibrous debris on the mesh, the flow area of the 5 inch x 38 inch gap below the door is sufficient to allow the flow of the commensurate CS and RCS spillage. It is not credible that a large section of debris could make a turn in the access way and then deposit itself strategically on the gap beneath the door to effect an appreciable flow impediment. The initial loss of coolant from a LBLOCA would deposit water in a SG Bay to a depth of approximately 3 feet. Velocities due to subsequent CS and RCS spillage flow approaching the door would be less than 1 foot/sec. The driving "head" to cause this flow is a fraction of an inch. The water retention associated with a SG Bay having a water level a fraction of an inch higher than the sump level is negligible.

REFUELING CAVITY

The refueling cavity will collect about 24% of the Containment Spray flow and begin to fill. Water will flow out of the cavity through the drain which is open and dump to the floor outside the bioshield during power operations. If multiple pumps are operating, the cavity will fill to elevation 1013; at that point, a second flow path will come into play. Water will flow through a gap under the reactor seal ring, into the reactor cavity and up through the reactor cavity access well to the 994 floor. The reactor cavity access well is a significant water retention that is accounted for in the calculation of Post –LOCA water level.

<u>Exception(s) Taken to the GR and SER for Upstream Effects</u>

At this time, OPPD does not expect to take any exceptions to the GR or the SER recommendations regarding upstream effects.

10. <u>Downstream Effects</u>

As previously described in the OPPD Answer to NRC Request 2a above, a downstream effects evaluation has been performed for FCS. Review and acceptance of the downstream effects evaluation is in progress. However, the results described below are not expected to change significantly.

The methodology used for performing this evaluation was in accordance with the recommendations and guidance contained within the GR, the SER, and WCAP-16406-P (Reference 9). The approach used in this evaluation was to:

- Identify the ECCS and CSS flow paths, including all intervening components that are required following a LOCA and subsequent transfer to recirculation.

- Calculate the quantity of debris that would be expected to pass through the strainer based on the expected sump strainer screen opening of less than or equal to 3/32 inch.
- Determine the characteristics of the debris that was determined to pass through the strainer.
- Evaluate the previously identified flow path components to determine if they could potentially become blocked as a result of the debris in the ECCS or CTS fluid.
- Evaluate the potential wear of critical components to determine if their design basis functions could be maintained for the required mission time of 30 days.

Preliminary results form the blockage and wear evaluation determined that there are no required components or flow paths that are susceptible to blockage or wear by debris downstream of the sump strainer. Additional evaluation is in progress. See the OPPD Answers to NRC Requests 2d(v) and 2d(vi) of this submittal for additional information on downstream effects.

If the final results of the evaluation indicate that the projected effect of downstream debris on the ECCS pumps would result in unacceptable ECCS performance, OPPD will perform the necessary modifications or enhanced evaluations to ensure the established functions and mission time for the ECCS will be maintained throughout the course of the accident. If additional plant modifications are identified from technical evaluation of downstream effects, chemical effects or other technical reviews, a supplement to this GL response will be provided to describe the modification and associated schedule.

Exception(s) Taken to NEI the GR and SER for Downstream Effects

OPPD does not expect to take any exceptions to the GR or the SER recommendations regarding downstream effects. OPPD is using the WCAP as a guidance document and may deviate from this document as deemed appropriate by using alternative engineering evaluation methods.

NRC Request 2d(i):

[Include] The minimum available NPSH margin for the ECCS and CSS pumps with an unblocked sump screen.

OPPD Answer:

The CSS and HPSI pumps are used in the sump recirculation mode. The CSS pumps have less NPSH margin than the HPSI pumps. Therefore for simplification purposes, the NPSH margins discussed below are based on the CSS pumps. The minimum available NPSH margin for the CSS pumps at switchover to sump recirculation, not including the clean screen head loss, is 1.518 feet. (OPPD Answer to NRC Requests 2d(i) & Reference 12). The clean screen head loss is small (<0.20 feet based on vendor experience). These are preliminary values based on a proposed design change. See the table below for a summary of how NPSH is calculated. OPPD will be performing strainer head loss testing to determine the final NPSH margin for the new design. OPPD will update the final NPSH calculation upon completion of the strainer design.

Table 10 - Inputs used in calculating NPSH

Factor	Current Licensing/Design Basis	Proposed Licensing/Design Basis w/Strainer (LBLOCA)	Proposed Licensing/Design Basis w/Strainer (SBLOCA)
Pressure Head in Containment (Pcont – Pv) (ft)	8.99****	8.99	8.99
Static Head Height of water, Z (ft)	23.55	24.71	24.16
Piping/System Head Loss, h_f max. (ft)	3.87	3.87*	3.87*
Clean Strainer Loss (ft)	0.27	0.20	0.20
Strainer loss due to debris bed (ft)	0	1.012	1.012 ***
NPSH available (ft)	28.4	28.618*	28.068*
NPSH required (ft)	27.3	27.3*	27.3*
Margin for chemical affects (ft)**	1.1	1.318	0.768
Flow (gpm)	Strainer A : 4000 Strainer B : 6650	Strainer A : 4140 Strainer B : 6700	Strainer A : 4140 Strainer B : 6700

* Approximate because of slight change in flow rate and varying operating conditions. Additional conservatism is expected to be added to this value in the future due to new system modeling software.

** Actual expected chemical effects head loss is being developed. A validated value will be used in the final analysis.

*** SBLOCA Head loss conservatively uses LBLOCA value but is expected to be lower and may be bounded by LBLOCA

**** 8.99 feet of subcooling has been previously approved for FCS. This fixed value for Patm – P @ the sump pool temperature is considered a design limitation when the sump pool is below 195 degrees F.

NRC Request 2d(ii):

[Include] The submerged area of the sump screen at this time and the percent of submergence of the sump screen (i.e., partial or full) at the time of the switchover to sump recirculation.

OPPD Answer:

Based on the current proposed design the screens will be fully submerged at the time of switchover. The submerged screen area will be approximately 2800 square feet at the time of switchover. The design sump screen area following planned modifications has not been finalized.

The Small Break LOCA water level at OPPD is approximately 0.5 foot less than the LBLOCA water level. Full submergence during the SBLOCA may not be required due to the reduced debris loads and lower sump pool temperature at the time of recirculation. Since it may be desirable to make the strainer taller to maximize floor space usage, surface area and increase margin for unknowns such as chemical effects, partial submergence during the SBLOCA is being evaluated. If the strainer is not fully submerged during the SBLOCA, OPPD will identify the revised extent of submergence upon completion of the strainer design.

NRC Request 2d(iii):

[Include] The maximum head loss postulated from debris accumulation on the submerged sump screen, and a description of the primary constituents of the debris bed that result in this head loss. In addition to debris generated by jet forces from the pipe rupture, debris created by the resulting containment environment (thermal and chemical) and CSS washdown should be considered in the analyses. Examples of this type of debris are disbonded coatings in the form of chips and particulates and chemical precipitants caused by chemical reactions in the pool.

OPPD Answer:

The maximum postulated head loss from debris accumulation on the submerged sump screen is specified to be 1.212 feet of water or less. The primary constituents of the debris bed are as follows: Calcium Silicate/Asbestos, Cerafliber, Foam Rubber, NUKON, Temp-Mat, RMI, coating debris, latent debris (Reference 5) and chemical effects materials.

Three break locations were considered :

- largest potential for debris with the highest calcium silicate to fiber ratio (LBLOCA)
- largest potential for debris with the highest fiber to calcium silicate ratio(LBLOCA)
- most direct path to the sump (SBLOCA).

Each case was analyzed separately with large pieces and fines

In addition, two debris load cases are evaluated:

Case 1 Steam Generators/pressurizer with Reflective Metallic Insulation (RMI) and the remaining material per walkdown report.

Case 2 All CalSil/Asbestos inside the bioshield replaced with low density fiberglass insulation, such as Thermal wrap or NUKON, and the remaining material the same as Case 1.

After performing a cost analysis associated with the removal of the CalSil/Asbestos, Case 2 was deemed impractical.

The above debris does not include final debris resulting from chemical effects.

Additional margin may be recovered using evaluation alternatives such as Alternate Break Methodology or changes to the currently approved amount of overpressure/subcooling utilized at FCS.

Additional margin to account for chemical precipitants by chemical reactions has been accounted for by utilizing a very large passive strainer that has very low approach velocities. The maximum and worst combination of debris loadings were utilized in the analysis. Erosion of debris was accounted and hence, is considered conservative with respect to maximum head loss predictions. As such, conservatism was applied in developing NPSH margin.

Recently OPPD reevaluated containment subcooling to support replacement steam generators (Reference 16). It was determined in safety related assessments utilizing conservative methods that the worst (lowest) containment overpressure at RAS was determined to be 16.34 feet. for the DEGB hot leg break, minimum safeguards, and cold conditions. Therefore, the containment overpressure credited in the containment spray pump NPSH calculation (8.99 feet; USAR Section 6.2) is below the minimum calculated available containment overpressure (16.34 feet). This supports the conclusion that the existing NPSH calculations are conservative, and additional margin is available to accommodate other impacts such as chemical affects (an additional 7.35 feet overpressure at RAS). OPPD recognizes that crediting any overpressure or subcooling greater than 8.99 feet will require a license amendment.

NRC Request 2d(iv):

[Include] The basis for concluding that the water inventory required to ensure adequate ECCS or CSS recirculation would not be held up or diverted by debris blockage at choke-points in containment recirculation sump return flowpaths.

OPPD Answer:

The water inventory required to ensure adequate sump pool level and sump pool flow paths were evaluated as part of the GSI-191 walkdowns during the 2003 RFO (Reference 10). Additional walkdowns were performed during the 2005 RFO to collect additional data on doors and drains. As part of this effort a new containment water level calculation (Reference 15) was developed to determine hold up quintiles and actual sump pool depth. As a result of this evaluation, a water hold up volume in the refueling cavity was identified. This water holdup is due to the 4 inch diameter drain line being minimally sized for multiple spray pump operation. Flow past the RPV flange seal is currently being credited as an alternate flow path. This condition was found acceptable for the current design, however, to minimize water holdup and increase sump pool depth (for increased NPSH margin), a modification to the install spacers in the RPV Flange Seal will be installed during the 2006 RFO. In addition, the drain cap in the RPV sump pit will be modified to reduce the potential for plugging. No additional choke points or flow diversions were identified.

NRC Request 2d(v):

[Include] The basis for concluding that inadequate core or containment cooling would not result due to debris blockage at flow restrictions in the ECCS and CSS flowpaths downstream of the sump screen, (e.g., a HPSI throttle valve, pump bearings and seals, fuel assembly inlet debris screen, or containment spray nozzles). The discussion should consider the adequacy of the sump screen's mesh spacing and state the basis for concluding that adverse gaps or breaches are not present on the screen surface.

OPPD Answer:

The evaluation for flow paths downstream of the containment sump is a two phase approach. The first phase is a blockage evaluation focused on maximum particle size and the potential for blockage due to debris passing through the sump screen (Reference 9). The acceptance criteria were based on guidance provided in WCAP-16406-P. The second phase is long term wear effects and includes effects on the RPV core.

The blockage Phase 1 (Reference 17) evaluations were done for all components in the recirculation flow paths including, but not limited to, throttle valves, flow orifices, spray nozzles, pumps, heat exchangers, and valves. Preliminary results indicate a strainer hole size of 3/32 inch will be acceptable.

The methodology employed in this evaluation is based upon input obtained from a review of the recirculation flow path shown on Piping and Instrument Diagram Drawings and plant procedures. The steps used in obtaining the flow clearance are as follows:

- Determine the maximum characteristic dimension of the debris (clearance through the sump screen).
- Identify the recirculation flow paths.
- Identify the components in the recirculation flow paths.
- Review the vendor documents (drawings and/or manuals) for the components to obtain flow clearance dimensions.
- Determine blockage potential through a comparison of the flow clearance through the component with the flow clearance through the sump screen.
- Identify the components that require a detailed evaluation and investigation of the effects of debris on their capability to function.

The results of the flow clearances are summarized in Table 11 for components with a flow clearance less than or equal to a screen size of 3/32 inch diameter plus ten percent, i.e., 0.103 inches.

Table 11

Component ID	Description	Clearance
SI-1A SI-1B	LPSI Pumps – Wear Ring Clearance	0.019 inch
SI-3A SI-3B SI-3C	CS Pumps – Wear Ring Clearance	0.019 inch
SI-2A SI-2B SI-2C	HPSI Pumps – Wear Ring Clearance	Not specified

The HPSI pump wear ring clearances are not specified in the pump manual. The motion of the pump impeller will ensure that these clearances are not a clogging issue. However they will be evaluated for long term wear effects as discussed in the OPPD Answer to NRC Request 2d(vi) below.

In addition, the clearance for the components identified in Table 12 are greater than 110% time the sump screen size and less than 200% of the sump screen size (0.1875 inches).

Table 12

Component ID	Description	Clearance
SI-2A SI-2B SI-2C	HPSI Pump – Mechanical Seal Cooling Piping Orifice	0.140 inch
SI-1A-1 SI-1B-1	LPSI Pump Mechanical Seal Heat Exchanger	0.152 inch
SI-3A-1 SI-3B-1 SI-3C-1	CS Pump Mechanical Seal Heat Exchanger	0.152 inch
CH-6	Regenerative Heat Exchanger	0.1875 inch
N/A	Containment Spray Nozzles	0.4375 inch

The HPSI LPSI and CS pumps cool the seals and bearings with pump discharge water as shown in the vendor manual. OPPD EA-FC-91-14 (Reference 18) has previously demonstrated that the pumps can tolerate a loss of all cooling with no loss of performance. Therefore, the Mechanical Seal Heat Exchanger clearances are not important to pump performance and are not considered limiting. The Regenerative Heat Exchanger (0.1875 inches) is the most limiting clearance with respect to determining the mesh size

As discussed in the OPPD Answer to NRC Request 2d(vi) the Phase 2 long term downstream evaluations are in progress. The resolution and corrective actions for the above components and the RPV will be performed with the long term evaluations.

NRC Request 2d(vi):

[Include] Verification that close-tolerance subcomponents in pumps, valves and other ECCS and CSS components are not susceptible to plugging or excessive wear due to extended post-accident operation with debris-laden fluids.

OPPD Answer:

Verification of debris blockage of downstream components is described in the OPPD Answer to NRC Request 2d(v). Verification of downstream components for long-term wear is in progress and is scheduled to be completed by June 30, 2006. This date is necessary if plant specific testing is required for debris head loss in the RPV. This work may be completed considerably sooner if analytical evaluation methods are found acceptable.

The results of preliminary analysis have not identified and downstream effects concerns that would require modifications to the plant. The FCS long term down stream effects evaluation will follow the guidelines of WCAP-16406-P to the extent practicable. However, alternative methods based on good engineering practices will be utilized if deemed appropriate since Reference 9 is a guidance document not currently approved with an SER.

NRC Request 2d(vii):

[Include] Verification that the strength of the trash racks is adequate to protect the debris screens from missiles and other large debris. The submittal should also provide verification that the trash racks and sump screens are capable of withstanding the loads imposed by expanding jets, missiles, the accumulation of debris, and pressure differentials caused by post-LOCA blockage under predicted flow conditions.

OPPD Answer:

The sumps are located outside of the bio-shield in the containment annulus area. The location of the sumps is not subject to missiles or pipe whip. Therefore, the screens are not subject to loads from missiles. There are no high energy lines in the immediate area of the sumps. A small line to the Regenerative Heat Exchanger Room is assumed for the debris case for the SBLOCA. This line is only a consideration if additional strainer modules are required beyond the currently proposed design. Trash racks are not included in the proposed strainer hardware design. The new screens will be designed to withstand the loads imposed by the accumulation of debris and pressure differentials under predicted flow conditions as specified in the design requirements, as well as seismically generated loads (Reference 10).

NRC Request 2d(viii):

[Include] If an active approach (e.g., backflushing, powered screens) is selected in lieu of or in addition to a passive approach to mitigate the effects of the debris blockage, describe the approach and associated analyses.

OPPD Answer:

FCS does not plan to install an active strainer design.

NRC Request 2e:

[Provide] A general description of and planned schedule for any changes to the plant licensing bases resulting from any analysis or plant modifications made to ensure compliance with the regulatory requirements listed in the Applicable Regulatory Requirements section of this generic letter. Any licensing actions or exemption requests needed to support changes to the plant licensing basis should be included.

OPPD Answer:

Two potential license amendments are currently being considered by OPPD. OPPD will only implement one of the two options if a license amendment is processed. OPPD is considering the potential use of Alternate Evaluation methods. Use of this methodology is not expected to require a license amendment. However, 50.59 evaluation would be required to determine if a license amendment would be required. The options are as follows:

1. Subcooling and Overpressure
   FCS has a limited NPSH margin. The current design analysis includes credit for 8.99 feet of overpressure/subcooling. Additional subcooling or the methodology used to credit subcooling is currently being evaluated and may require a change. This method limits Patm – P @ the sump pool temperature to a maximum of 8.99 feet. The current calculations recently updated for the new Steam Generators, indicate that at least 16 feet of overpressure/subcooling is available. It is understood that regulatory approval will be required for crediting any design/licensing changes relating to overpressure or subcooling.

2. Containment Spray Pump Operation
   OPPD currently has a temporary allowance in the FCS Technical Specifications to allow securing two of the three operating containment spray pumps during a LOCA. An alternative design being evaluated is to automatically secure one Containment Spray Pump (SI-3C) by defeating the pump auto-start feature. This potential modification may be implemented as an alternative to the license amendment if adequate NPSH margin can be gained.

The options are being evaluated as part of a planned design/licensing optimization phase. Completion of strainer hardware testing and requirements from downstream and chemical effects are required to support the decision regarding the need for a license amendment. OPPD plans to identify the need for any license amendments by December 31, 2005.

NRC Request 2f:

[Provide] A description of the existing or planned programmatic controls that will ensure that potential sources of debris introduced into containment (e.g., insulations, signs, coatings, and foreign materials) will be assessed for potential adverse effects on the ECCS and CSS recirculation functions. Addressees may reference their responses to GL 98-04, "Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System after a Loss-of-Coolant Accident Because of Construction and Protective Coating Deficiencies and Foreign Material in Containment," to the extent that their responses address these specific foreign material control issues.

OPPD Answer:

(1) OPPD plans to implement a containment insulation configuration control program that will be utilized to ensure that future changes to insulation inside containment is bounded by the new design basis calculation developed as part of GSI-19. This program will require engineering approval for all future insulation changes in containment. The Containment Insulation Control Program provides controls to maintain the inventory of insulation inside of containment such that the amount and type remains within the acceptable design margin for debris loading of the containment sump suction strainers following a LOCA. The program control procedure will establish responsibilities and general requirements for preparing, reviewing, approving and processing configuration changes to insulation installed in the containment at FCS. In addition to the engineering control procedure, FCS plans to implement a program basis document for containment insulation control.

(2) OPPD plans to implement a latent debris collection procedure. The procedure is used to collect latent debris samples from more than 20 locations inside containment including both horizontal and vertical surfaces. The procedure will be used to calculate the total latent debris load. This value is then compared to the values used in the Debris Generation and Transport analysis to ensure OPPD remains within the design parameters specified. This procedure has been drafted and was used during the 2005 RFO. The 2005 results indicated debris loads less than the values used in the design basis calculations.

(3) OPPD presently has an approved Coatings Program. OPPD intends to maintain this program current to meet the industry requirements. As part of this program, a coatings walkdown and inspection is performed every outage. In addition, recoating of existing plant components typically takes place every refueling outage.

(4) The Foreign Material Exclusion (FME) program and control of signs and tags are existing programs/procedures and do not require any specific changes as a result of this generic letter. Improvements to the FME program were made in response to NRC Bulletin 2003-01.

References

1) NRC Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors" (NRC-04-0115)

2) Letter from Ralph L. Phelps, Omaha Public Power District (OPPD) to U.S. Nuclear Regulatory Commission (NRC) Document Control Desk, "90 Day Response to Nuclear Regulatory Commission Generic Letter 2004-02: Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors," Dated March 4, 2000 (LIC-05-0017)

3) Nuclear Energy Institute report NEI 04-07, "Pressurized Water Reactor Sump Performance Methodology," dated December 2004

4) Nuclear Energy Institute report NEI 02-01, "condition Assessment Guidelines: Debris Sources Insider PWR Containments," dated September 2002.

5) FCS Calculation FC06985, Rev. A, Fort Calhoun Station Debris Generation Post LOCA

6) FCS Calculation FC06987. Rev. A, Fort Calhoun Station Debris Transport Post-LOCA

7) FCS Calculation FC07123, Rev. A, Fort Calhoun Station LOCA Pool CFD Transport Analysis.

8) Letter from OPPD (Richard P. Clemens) to NRC (Document Control Desk) dated August 8, 2003 Fort Calhoun Station Unit No. 1, 60 Day Response to NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors" (LIC-03-0105)

9) Westinghouse document WCAP-16406-P, "Evaluation of downstream Sump Debris Effects in Support of GSI-191," dated June 2005.

10) WIP 201110, Enercon Services Report, OPP003-RPT-001, Rev. 0 3 Volumes and Master Spreadsheet Walkdown Update 200404a.xls

11) EPRI Report "Analysis of Pressurized Waters Reactor Unqualified Original Equipment Manufacturers Coating," dated March 2005.

12) Strainer Hardware Contract for RFP-1700 including GE Proposal No. 1724-JXDA7-7P1, Rev. 8

13) Sargent & Lundy LLC Evaluation No. 2005-10080, "GSI-191, Chemical Effects Evaluation" DRAFT

14) EA-FC-05-025 Containment Sump Upstream Effects

15) FC 07010 Rev. A, Minimum Containment Post-RAS Water Level

16) AREVA Report 32-5057181-00, FCS Document FC-06984, Rev. 0, FCS RSG-Sump Temperature Calculations

17) Sargent & Lundy LLC Engineering Evaluation No. 2005-08220, Rev. 0, "GSI-191 Downstream Effects – Flow Clearances"

18) EA-FC-91-014, Effects of Loss of Cooling Water on SI/CS Pumps, Rev. 1

19) PLDBD-ME-11, Internal Missiles and HELB, Rev. 9

ATTACHMENT 2

List of Commitments

Attachment 2
List of Commitments

COMMITMENT	Due Date/Event
• The FCS ECCS and CSS recirculation functions will be in compliance with the regulatory requirements listed in the Applicable Regulatory Requirements section of the subject generic letter under debris loading conditions. • A Generic Letter closeout response will be submitted. The final debris loaded head loss margin will be provided. This will include chemical effects. (AR 35967)	December 31, 2007